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Mapping of Crowdsourcing Research: A Bibliometric Analysis

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ABSTRACT

This study presented a bibliometric examination of the crowdsourcing publications. The objective of this study is to bibliometrically examine the publications related to crowdsourcing in the Science Citation Index Expanded of the Web of Science. A systematic search has been carried out for publications between 2008 and 2017. The parameters analysed included document type, language, most prolific journal, leading countries/territories, institutions and authors in terms of total publications, independent publications, collaborative publications, first authors, corresponding authors and single authors. Highly cited articles and the future direction of hot topics are also investigated. 81 per cent of the total publications are articles. English remains the dominant language and accounted for nearly 100 per cent of the total output. The USA, China and the UK produced 80 per cent of total production. *PLOS One* was leading journal in terms of total output and total citation till 2016. It was found that 1459 articles, including 1347 first authors, 1443 corresponding authors and 79 single authors, were published by 6973 authors. Fritz Steffen and See Linda were the most prolific authors. This paper will be useful for researchers to know the current trends and achievements of crowd - sourcing research.

Keywords: Crowdsourcing; Bibliometrics; Citation; Top-cited articles; SCI-expanded

1. INTRODUCTION

Jeff Howe first coined the terms "crowdsourcing" in Wired magazine in his article, The Rise of Crowdsourcing[1]. Since then this concept has been studied by scholars from different fields like computer science, business, economics, science and marketing. Crowdsourcing refers to the practice of involving a particular group of people (present online) referred to here as 'crowd' for getting a common goal or task accomplished. Crowdsourcing is the act of outsourcing undertakings to an expansive approximately characterised outer gathering of individuals[2].

The web is a vital part of crowdsourcing, and the benefit of utilising the internet over the more conventional techniques for completing an errand is that it enrols a considerable number of clients who are geologically exceptionally isolated. It is remarkable that the crowdsourcing system enables an extraordinary level of adaptability to the clients. They may complete an individual task in an incorporated framework alongside many co-clients, or they might be working individually on a particular job. Nowadays people are resorting to crowdsourcing as it is cost effective and involve a more diverse audience with their valuable experiences. It is also a great way to get people engaged to one's cause.

Studies have been conducted by scholars to explain the concept of crowdsourcing and how it helps in reducing production cost and make more competent use of labour and resources[3-4]. Researchers have conducted a literature review on crowdsourcing research in different perspectives to build up a complete picture of research regarding crowdsourcing[5-9]. Hosseini[10], *et al.* conducted a systematic mapping study to identify, categorise, and analyse existing literature related to crowdsourcing. However, a small number of studies has been performed on crowdsourcing from the bibliometric perspective.

To analyse the efficiency of crowdsourcing research, this study examined the literature of crowdsourcing in terms of bibliometric parameters. Bibliometrics helps to assess the impact of the publication, author's productivity, citation analysis, significant national and international contribution as well as recent trends in a particular field.

2. LITERATURE REVIEW

The three metric terms most commonly used are Bibliometrics, Scientometrics and Informetrics. Among them, the earliest metric field used for the statistical and mathematical analysis of books and other media is called bibliometrics[11]. Scientometrics is the second most commonly used metric method for the analysis of past, present and future scientific developments[12]. Scientists like Robert King Merton, Derek J. de Solla Price and Eugene Garfield are credited with its development[13-15]. The latest metric term of all three metric terms is Informetrics, which includes bibliometrics and scientometrics[16].

In recent years, new bibliometric methods, such as citation analysis and the journal impact factor, have flourished to evaluate the research output. Bibliometric indicators certainly

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have some merit in assessing the enormous research and development complex of modern societies[17]. There are many reasons why researchers carry out descriptive metric studies of a specific academic research. The most significant reason is to fathom the characteristics of a scientific discipline, on both futuristic and retrospect lines. In a more general sense, it helps to discover the entire intellectual core of a scientific field rather than focusing on its specific work[18].

There are studies that assess the scientific research production in terms of most prolific institutions, countries, authors, articles and journals[19-24]. These bibliometric studies can potentially provide investors' like journal editors, journal publishers, conference organisers, government research policy agencies, pioneers and leading researchers, research centers, and graduate programs[25], in policy-making and help them adjust their activities if required**.** The credit for scientific quality helps prominent scholars to communicate their achievements in and outside their field of knowledge and inspires them to contribute further. It also helps young researchers find academic guides[25].

3. OBJECTIVES

The study's specific objectives are to:

- Identify the document types and language distribution
- Show the growth of articles annually and their citations per publication (CPP) from 2008-2017
- Identify the leading WoS categories and journals
- Identify the leading Countries/territories, Institutions and authors in terms of total publications (TP), independent publications (IP), collaborative publications (CP), first authored publications (FP), corresponding authored publications (RP) and single-authored publications (SP).
- Identify the impact of most frequently cited articles
- Examine the author keywords.

4. METHODOLOGY

The data for this study was downloaded from the Science Citation Index Expanded (SCI-Expanded) of Clarivate Analytics (updated on 10 August 2018). Search terms "crowd-sourcing", "crowdsourcing" and "crowd sourcing" were used to search in the topic field, comprising a title, abstract, keywords and Keywords Plus from 2008 to 2017. Keywords Plus supplied supplementary search terms mined from the titles of articles cited by authors in their bibliographies and footnotes in the ISI database and significantly augmented title-word and author-keyword indexing[26].

In total 1796 documents published in the field of crowdsourcing research from 2008 to 2017, the annual citations for each paper in each year were downloaded into MS-Excel 2016, and further analysis related to citations was performed manually using the same spreadsheet software. Only journal articles were analysed. Impact factor (IF_{2016}) were taken from the JCR 2016. The total number of times an article was cited in the WoS Core Collection from its initial date of publication until the end of 2016 was recorded as TC2016[21,27]. The total number of citations per journal article, i.e., C2016 accrued in 2016 only was also recorded[24]. The advantage of TC2016 and C2016 is that they are constant and ensure repeatability in comparison with the WoS core collection citation index[19].

The corresponding author was named the " reprint author" in the SCI- Expanded database. It should be noted that the term " corresponding author" is used in the article[24]. In a single author article in which authorship is not specified,[38] the single author is both first author and corresponding author[24]. In the same way, for a single institution article, the institution was classified as the first author's institution and the corresponding author's institution[29]. Articles originating from England, Scotland and Wales have been clubbed under the United Kingdom[30].

5. PERFORMANCE OF PUBLICATIONS

5.1 Document Type and Language

We retrieved literature information for the time span from 2008 to 2017 which gave us a total of 1796 publication that were further classified into 13 document type. Table 1 displays an overview of the various aspects of documents under study. It turns out that there are a total of 1796 publication, of which the majority consists of articles 1459 (81.41 per cent), followed by editorial material 88 (4.9 per cent) and review 81 (4.51 per cent).

As it is eminent from the table that out of the total of 10082 citation till 2016, the bulk was contributed by articles

Table 1. Document types of crowdsourcing from 2008 to 2017

Document type	TP	P	TC2016	CPP	TNAu	ANAuPP
Article	1459	81.24	8318	5.7	5596	3.84
Editorial material	88	4.9	391	4.44	280	3.18
Review	81	4.51	940	11.6	350	4.32
Proceeding papers	56	3.12	77	1.38	255	4.55
Meeting abstract	55	3.06	6	0.11	275	5
News items	19	1.06	6	0.32	16	0.84
Corrections	13	0.72	1	0.08	73	5.62
Letter	13	0.72	31	2.38	58	4.46
Book chapter	5	0.28	311	62.2	12	2.4
Book review	3	0.17	1	0.33	3	1
Data paper	2	0.11	0	0	51	25.5
Retracted publications	1	0.06	0	0	2	2
Retraction	1	0.06	0	0	2	2
Total	1796	100	10082	5.61	6973	3.88

TP: Total number of articles; *P:* Percentage; *TC2016:* total citations up to 2016; *CPP:* citations per publication; *TNAu:* Total Number of Authors; *ANAuPP:* Average Number of Authors Per Publication.

with 8318 citation which amounted to 5.7 CPP. There were a total of 5596 author for these articles which stood at 3.84 article per author. In addition to this according to the results, 81 review article were cited 940 time, accounting for 11.6 CPP. The total numbers of authors contributing such articles were 350. Following review was an editorial material which contributed 391 citation till 2016, rounding off to about 4.44 CPP. The total number of authors contributing to these citations was 280 resulting in 3.18 author per paper.

Figure 1 shows the relationship between the number of articles in a research area and their CPP from 2008 to 2017. As it is evident from the figure that the annual number of articles shows a gradual upward trend during the period under study, which designates the growing interest of researchers in the field of crowdsourcing. However, the CPP surges first and decreases abruptly; it is because of a significant amount of publication output.

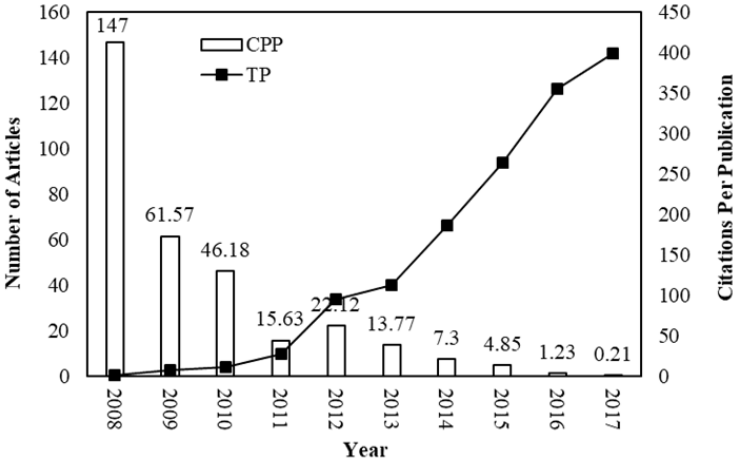

Figure 1. Annual number of articles and CPP by year.

5.2 Web of Science Categories and Journals

According to JCR report 2016 which was published in 2017, it indexes more than 11500 journal across 236 disciplines and 81 country (https://clarivate.com/blog/the-2017-jcr-release-is-here/). With citation references across 177 WoS categories in SCI-Expanded. It was found that crowdsourcing research publication data were extensively spread across 163 categories. In total 1459 article were published in 581 journal. Out of these journals, 330 (56.90 %) published only one article, 105 (18.10 %) journal published two articles, and 50 (8.62 %) journals published three articles. Rest 95 (16.38 %) journals published four or more than four article. These 95 journal contributed 768 (52.67 %) article out of 1459 article.

Table 2 displays the top 10 productive journal which hosted a total of 209 article out of 1459 article, accounting for approx. 14.32 per cent of total articles. *PLOS One* (IF_{2016}=2.806) published the highest number of articles, i.e. 39 (2.67 per cent) followed by *IEEE Transactions on*

Table 2. The ten most productive journals with the number of articles, and impact factor during the period of 2006 to 2017

Source title	TP (P)	IF_{2016}	TC2016	Country	WoS
Plos One	39 (2.67)	2.806	455	USA	Multidisciplinary Sciences
IEEE Transactions on Multimedia	24 (1.64)	3.509	115	USA	Computer Science Information Systems Computer Science Software Engineering Telecommunications
Journal of Medical Internet Research	23 (1.58)	5.175	243	Canada	Health Care Sciences & Services Medical Informatics
IEEE Transactions on Knowledge and Data Engineering	21 (1.44)	3.438	27	USA	Computer Science Artificial Intelligence Computer Science Information Systems Engineering Electrical & Electronic
IEEETransactions on Mobile Computing	20 (1.37)	3.822	46	USA	Computer Science, Information Systems Telecommunications
ACM Transactions on Intelligent Systems and Technology	18 (1.23)	3.196	13	USA	Computer Science, Artificial Intelligence Computer Science, Information Systems
Expert Systems with Applications	17 (1.17)	3.928	42	England	Computer Science, Artificial Intelligence Engineering, Electrical & Electronic Operations Research & Management Science
International Journal of Human Computer Studies	16 (1.1)	2.863	25	England	Computer Science, Cybernetics Ergonomics Psychology, Multidisciplinary
Sensors	16 (1.1)	2.677	41	Switzerland	Chemistry, Analytical Electrochemistry Instruments & Instrumentation
Computer Networks	15 (1.03)	2.516	31	Netherlands	Computer Science, Hardware & Architecture Computer Science, Information Systems Engineering, Electrical & Electronic Telecommunications

TP: the total number of articles; *P:* the percentage of articles of journals in total articles*;* IF_{2016}*:* impact factor in 2016; *TC2016:* total citations of the articles till 2016; *WoSc:* Web of Science Categories

Table 3. The top 15 most productive countries

Country	TP	TPR (P)	IPR (P)	CPR (P)	FPR (P)	RPR (P)
USA	707	1 (48.65)	1 (44.84)	1 (55.1)	1 (28.16)	1 (43.24)
Peoples R China	263	2 (18.15)	2 (13.19)	2 (26.53)	2 (14.42)	2 (14.9)
UK	204	3 (14.08)	3 (6.92)	3 (26.16)	3 (6)	3 (7.48)
Germany	123	4 (8.49)	4 (3.63)	4 (16.7)	4 (5.45)	4 (4.16)
Italy	83	5 (5.73)	4 (3.63)	8 (9.28)	7 (3.73)	5 (3.53)
Canada	71	6 (4.9)	6 (2.42)	9 (9.09)	6 (4.42)	6 (2.91)
Australia	70	7 (4.83)	10 (1.43)	5 (10.58)	5 (4.76)	9 (2.01)
France	63	8 (4.35)	17 (0.88)	7 (10.2)	9 (2.9)	10 (1.94)
Switzerland	57	9 (3.93)	13 (1.21)	10 (8.53)	20 (1.1)	15 (1.39)
Netherlands	54	10 (3.73)	6 (2.42)	12 (5.94)	10 (2.42)	7 (2.36)
Austria	49	11 (3.38)	10 (1.43)	11 (6.68)	8 (2.97)	8 (2.29)
Spain	41	12 (2.83)	13 (1.21)	13 (5.57)	14 (1.45)	11 (1.59)
Singapore	37	13 (2.55)	20 (0.77)	13 (5.57)	24 (0.69)	18 (1.04)
India	36	14 (2.48)	10 (1.43)	17 (4.27)	11 (1.79)	12 (1.52)
Greece	32	15 (2.21)	16 (0.99)	17 (4.27)	16 (1.24)	16 (1.18)

TP: total number of articles; *TPR (P):* Total articles rank and Percentage; *IPR (P):* Independent article rank and percentage; *CPR (P):* internationally collaborative article rank and percentage; *FPR (P):* first author article rank and percentage; *RPR (P):* corresponding author article rank and percentage.

Multimedia 24 (1.64 per cent) and *Journal of Medical Internet Research* with 23 (1.58 per cent). The journal with the maximum impact factor among top ten contributing journals for the year 2016 was of *Medical Internet Research* (IF_{2016}=5.175) and published a total of 23 articles. However, it is worth mentioning that *PLOS One* journal which is the most productive journal received a total of 455 citations till 2016 which as can be seen is relatively high as compared to others. One reason is that *PLOS One* is a multidisciplinary open access journal having a broad spectrum thus such high citation. As crowdsourcing was a concept that dealt with online public users, therefore, most of the articles are in the journal having WoS categories such as Computer Science, Information System, Artificial Intelligence and so on.

5.3 Country and Institution

Researchers from various countries contributed to the publications of extracted documents. Countries with maximum productivity are listed in Table 3. To reflect the contribution of countries and institutions six indicators were used those are: TP, IP, CP, FP, RP and SP[17,28,31]. It was revealed that at the institutional level, the determined institution of the corresponding author could be the basis of the paper's study or origin[24].

Out of 1459 article, ten article were without author affiliation information. Country and

Table 4. The top 14 most productive institutions (TP ≥ 18)

Institution	TP	TPR (P)	IPR (P)	ICPR (P)	FPR (P)	RPR (P)
University Oxford (UK)	36	1 (2.48)	18 (0.64)	2 (2.95)	44 (0.28)	3 (0.97)
Tsinghua University (China)	33	2 (2.28)	18 (0.64)	1 (3.05)	21 (0.48)	1 (1.46)
Stanford University (USA)	32	3 (2.21)	7 (0.86)	3 (2.85)	9 (0.69)	1 (1.46)
MIT (USA)	30	4 (2.07)	18 (0.64)	4 (2.75)	3 (0.97)	2 (1.11)
University of Washington (USA)	28	5 (1.93)	1 (1.28)	6 (2.14)	25 (0.41)	2 (1.11)
Chinese Academy of Sciences (China)	26	6 (1.79)	N/A	5 (2.65)	1 (1.31)	3 (0.97)
University California Berkeley (USA)	23	7 (1.59)	18 (0.64)	7 (2.04)	37 (0.35)	5 (0.69)
Harvard University (USA)	21	8 (1.45)	95 (0.21)	7 (2.04)	12 (0.62)	11 (0.49)
University Michigan (USA)	21	8 (1.45)	95 (0.21)	9 (1.83)	74 (0.21)	3 (0.97)
New York University (USA)	20	10 (1.38)	3 (1.07)	12 (1.53)	15 (0.55)	2 (0.76)
Columbia University (USA)	19	11 (1.31)	7 (0.86)	12 (1.53)	6 (0.76)	15 (0.42)
Hong Kong University Science& Technology (China)	19	11 (1.31)	18 (0.64)	10 (1.63)	15 (0.55)	4 (0.62)
University Illinois (USA)	18	13 (1.24)	38 (0.43)	12 (1.53)	74 (0.21)	17 (0.35)
University of North Carolina (USA)	18	13 (1.24)	18 (0.64)	12 (1.53)	74 (0.21)	11 (0.49)

TP: total number of articles; *TPR (P):* total articles rank and percentage*: IPR (P):* single institution articles rank and percentage; *ICPR (P):* internationally collaborative articles rank and percentage; *FPR (P):* first author articles rank and percentage; *RPR (P):* corresponding author articles rank and percentage; *N/A:* not available.

institution analysis was done on 1449 article from 86 countries. Out of 1449 article, 911 (62.85 per cent) were Single Country Articles from 43 Countries. Internationally collaborative articles from 85 countries represented 538 (37.15 per cent). Table 4 shows the top 15 prolific countries, it can be seen USA was the highly productive country with a total of 707 articles, far followed by China with a total of 263 article, followed by UK (204), Germany (123) and Italy (83) at 3rd, 4th and 5th positions respectively. India secured the 14th position with a total of 36 article. It has also been observed that the USA, China, UK and Germany occupied 1st, 2nd, 3rd and 4th positions in all the indicators respectively.

Of the 1449 article with author affiliations in WoS, 467 articles are single institution articles which contribute 32.23 per cent. 982 (67.77 per cent) articles out of 1449 were from international collaboration. Table 4 displays top 14 most productive institutions which have published at least 18 article and exhibits the rankings and percentages of five indicator including a total number of articles and number of single institution, internationally collaborative, first author and corresponding author articles. Out of the 14 most prolific institutions, 10 (71.42 per cent) were in the USA, three were in China and one in the UK. The University of Oxford in the USA ranked first in a total number of articles and second in articles with international cooperation. The University of Washington in the USA had most single institution articles but was ranked fifth in terms of total publication. Tsinghua University in China ranked 1st in internationally collaborative articles; it also produced the most corresponding author articles.

5.4 Leading Articles

Articles with highest citations give a remarkable and useful vision regarding a particular research domain over a specific time. Indicator TC2016 provides an insight about the articles since their publication, while as C2016 might provide insight into recent research in a particular research domain[31].

Table 5 shows the ten article having C2016 ≥ 46. All these articles were published in different journals; it was found that *PLOS ONE* which is the leading journal, contributes one article among the category of high impact articles in recent years which occupies the second rank. The article published in the *Journal of Information Science* (IF_{2016}=1.372) published an article titled *"*Towards an integrated crowdsourcing definition*"* by Estellés-Arolas & González-Ladrón-de-Guevara was first regarding both TC2016 and C2016. The authors analysed the existing definitions of crowdsourcing in this article to extract common elements and to establish the basic characteristics of any crowdsourcing initiative. Figure 2 shows the citation number of six article in TC2016. Two article titled "Leveraging crowdsourcing: Activation-supporting components for IT-Based ideas competition" and "Learning from crowds" showed a parallel trend of annual citation number. The annual citations of two articles ranked 1st and 4th in TC2016 show an abrupt increase in citations.

5.5 Authorship

An analysis of authors publications using indicators such as TP, FP, RP and SP were used. It was found that 6973 author published 1459 article included 1347 first author, 1443 corresponding author, and 79 single author. Table 6 shows the

Table 5. The ten most frequently cited articles in 2016 (C2016 > 45)

R (C2016)	R (TC2016)	Title	Authors
1 (94)	1 (236)	Towards an integrated crowdsourcing definition	Estellés-Arolas & González-Ladrón-de-Guevara, 2012
2 (91)	4 (190)	Evaluating amazon's mechanical turk as a tool for experimental behavioral research	Crump, McDonnell & Gureckis, 2013
3 (85)	15 (90)	Nanotechnology in the real world: redeveloping the nanomaterial consumer products inventory	Vance, *et al.*, 2015
4 (58)	3 (200)	Learning from crowds	Raykar, *et al.*, 2010
5 (57)	5 (168)	The value of crowdsourcing: can users really compete with professionals in generating new product ideas?	Poetz & Schreier, 2012
6 (53)	18 (70)	Crowdsourcing a word-emotion association lexicon	Mohammad & Turney, 2013
7 (52)	12 (111)	Crowdsourcing new product ideas over time: an analysis of the Dell Ideastorm Community	Bayus, 2013
8 (50)	22 (66)	Dbpedia - a large-scale, multilingual knowledge base extracted from wikipedia	Lehmann, *et al.*, 2012
9 (48)	2 (219)	Crowdsourcing geographic information for disaster response: A research frontier	Goodchild & Glennon, 2010
10 (46)	7 (132)	Assuring the quality of volunteered geographic information	Goodchild & Li, 2012

TC2016: number of citations till 2016; *C2016:* Number of citations in 2016

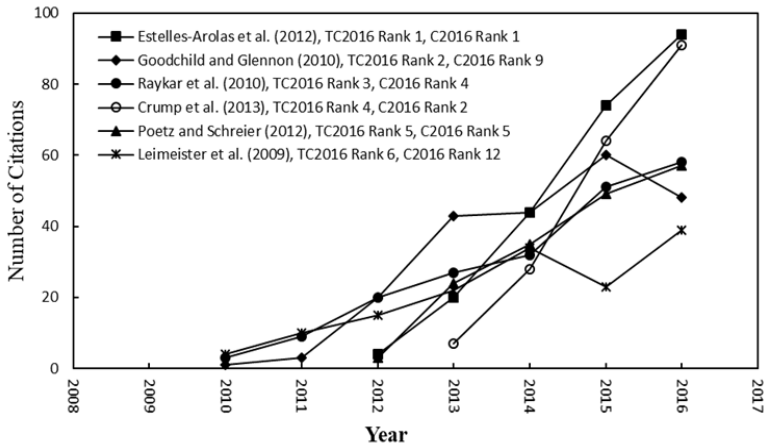

Figure 2. Citation life cycle of the six article ranked top in TC2016.

Table 6. Top 12 most productive authors (TP≥7) in crowdsourcing research

Author	TP	TPR (P)	FPR (P)	RPR (P)	SPR (P)
Fritz Steffen	17	1 (1.2)	13 (0.1)	3 (0.3)	N/A
See Linda	17	1 (1.2)	5 (0.2)	3 (0.3)	N/A
McCallum Ian	10	3 (0.7)	93 (0.1)	N/A	N/A
Perger Christoph	10	3 (0.7)	N/A	N/A	N/A
Sheng Victor S	9	5 (0.6)	93 (0.1)	N/A	N/A
Stolovitzky Gustavo	9	5 (0.6)	13 (0.1)	35 (0.1)	N/A
Obersteiner Michael	9	5 (0.6)	N/A	N/A	N/A
Kraxner Florian	8	8 (0.5)	13 (0.1)	N/A	N/A
Rudan Igor	7	9 (0.5)	13 (0.1)	N/A	5 (1.3)
Zhang Jing	7	9 (0.5)	2 (0.3)	N/A	N/A
Schall Daniel	7	9 (0.5)	1 (0.4)	3 (0.3)	1 (2.5)
Van der VeldeMarijn	7	9 (0.5)	N/A	N/A	N/A

TP; Total articles *TPR (P);* Total Article rank and percentage *FPR (P);* First Author article rank and Percentage *RPR (P)*; Corresponding Author Article rank and Percentage *SPR (P);* Single Author Article rank and Percentage *NA;* Not Available

12 most prolific author (those who have published 7 or more articles) in the field of crowdsourcing. As it is evident from the table Fritz Steffen and See Linda both hold the first rank as both have 17 publication each to their names, both of them are from International Institute for Applied Systems Analysis of Austria. However, Schall Daniel from Siemens Corporate Technology of Austria published the most first and single-authored articles.

5.6 Author Keywords

Keywords of an article published can reflect the article's main content[32]. The statistical analysis of keywords might also help to discover the interests towards a particular science domain[23]. It can also help to identify hot research topics and future directions in the field of knowledge.

Literature search constitutes an essential and critical step in research writing. Keywords help in letting the researchers find out the most relevant articles related to the topic or query. Keywords make the paper more discoverable and thus ensure more citations. Hence it is imperative the keyword we chose for an article to represent the contents of the article and are most applicable to the articles. Original author keywords for each article related to crowdsourcing were examined (Table 7). It was found that 6129 keywords were used, 3281 (53.53 per cent) keywords were used only once, 2607 (42.54 per cent) were used twice. Table 8 shows the top 15 keywords used in the publications under study. As crowdsourcing was used as a search term, it is not a surprise that it showed the highest frequency (746 times). Other top 4 keywords that showed higher appearance frequency is "citizen science" (46), "social media" (34), "human computation" (27) and "mobile crowdsourcing" (22). The keyword analysis revealed that crowdsourcing had broad applications in citizen science, social media and human computation.

6. DISCUSSION AND CONCLUSION

Bibliometric analysis of crowdsourcing articles in the SCI-Expanded from 2008 to 2017 has been conducted. The

Table 7. Fifteen most frequently used author keywords

Author Keywords	TP	R (P)
Crowdsourcing	746	1 (64.9)
Citizen Science	46	2 (4.01)
Social Media	34	3 (2.96)
Human Computation	27	4 (2.35)
Mobile Crowdsourcing	25	5 (2.18)
Volunteered Geographic Information	22	6 (1.92)
Human Factors	20	7 (1.74)
Big Data	20	7 (1.74)
Machine Learning	20	7 (1.74)
Design	18	10 (1.57)
Open Innovation	17	11 (1.48)
Social Networks	15	12 (1.31)
Classification	15	12 (1.31)
Incentive Mechanism	15	12 (1.31)
Performance	14	15 (1.22)

TP; Total Publications *R;* Rank *P*; Percentage

investigation was performed on a total of 1796 publications. To investigate the publication output quantitatively of countries, institutions, journals, and leading articles. Some well-defined indicators such as total publication (TP), Internationally collaborative articles (CP), Independent articles (IP), First author articles (FP), Corresponding author articles (RP), Single author articles (SP) and Citation per publication (CPP) were used. It was found that the USA was the country with most publication followed by China. Among leading fourteen institutions, 10 were from the USA, three from China and one from the UK. It was discovered that Fritz Steffen and See Linda were most productive authors with both having 17 publication. It was found that the article "Towards an integrated crowdsourcing definition" by Estellés-Arolas & González-Ladrón-de-Guevara was the leading article with a total of 236 citation till the year 2016. Keyword analysis revealed that "crowdsourcing" term had the highest frequency (746).

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